

CHAPTER 5

CUMULATIVE IMPACTS

5.1 INTRODUCTION

The analysis presented in this chapter, as required by CEQ regulations (40 CFR 1500-1508), addresses the potential cumulative impacts associated with all project Alternatives. The CEQ regulations state that the cumulative impact analysis should include the anticipated impacts to the environment resulting from “the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time” (40 CFR 1508.7).

What is the Process of Assessing Cumulative Impacts?

The cumulative impact analysis in the following sections builds upon the analyses of the direct and indirect impacts discussed in **Chapter 4**, Environmental Consequences. The cumulative impact analysis considers: (1) the combined effect of all three Proposed Actions (SPPC, Ormat, and Vulcan, or Whole of the Action); and (2) other past, present, and reasonably foreseeable future actions’ impacts on natural resources, ecosystems, and human communities in the Salt Wells Energy Projects Area (Other Cumulative Projects).

What is the Methodology?

The cumulative effects analysis focuses on the natural resources, ecosystems, and human communities that could be affected by the impacts from all project Alternatives, in combination with other past, present, and reasonably foreseeable future actions, regardless of who undertakes them.

The CEQ discusses the assessment of cumulative effects in detail in its report, “Considering Cumulative Effects under the National Environmental Policy Act” (CEQ 1997). Based on the CEQ’s report, the following methodology was developed for assessing cumulative impacts:

- I. The geographic scope (i.e., ROI) is defined for the analysis. The ROIs encompass the areas of affected resources and the distances at which impacts associated with anticipated future actions to be taken consistent with the project Alternatives may occur. To determine which other actions should be included in a cumulative impacts analysis, the regions

of influence must first be defined. These regions should not be limited to only the geographic areas of resources addressed by the project Alternatives, but they should also take into account the distances that cumulative impacts may travel and the regional characteristics of the affected resources. The cumulative ROIs for each resource are identified below.

2. The time frame for the analysis is defined. The temporal aspect of the cumulative impacts analysis generally extends from the past history of impacts on each resource through the anticipated life of the project (and beyond, for resources having more permanent impacts). The time frame of the cumulative impact analysis incorporates the sum of the effects of anticipated future actions consistent with the implementation of the project Alternatives in combination with other past, present, and future actions, because impacts may accumulate or develop over time. The future actions described in this analysis are those that are “reasonably foreseeable;” that is, they are ongoing (and will continue into the future), are funded for future implementation, or are included in firm near-term plans. The reasonably foreseeable time frame for future actions evaluated in this cumulative analysis is 20 years from the allocation of lands available for geothermal leasing and completion of land use plan amendments. While it is difficult to project reasonably foreseeable future actions (or trends) beyond a 20-year time frame, it is acknowledged that the effects identified in the cumulative impacts analysis would likely continue beyond the 20-year horizon.
3. Past, present, and reasonably foreseeable future actions are identified. These include projects, activities, or trends that could impact human and environmental resources within the defined regions of influence during the defined time frame. Past and present actions are generally accounted for in the analysis of direct and indirect impacts for each resource and are carried forward to the cumulative impacts analysis. **Tables 5-1 through 5-3, Figures 5-1 through 5-3 and Appendix F**, Land Use Authorizations in the Salt Wells Energy Projects Area, identify known past, present, and reasonably foreseeable future actions within the ROIs. BLM land management activities also occur and would continue in the ROIs.
4. The baseline conditions of resources are characterized. Baseline characteristics are described in the affected environment sections for each resource in **Chapter 3, Affected Environment**.
5. Direct and indirect impacts on resources from anticipated future actions that may be taken consistent with the respective Alternatives are characterized. Direct impacts are caused by anticipated future actions to

**Table 5-1
Past, Present and Reasonably Foreseeable Future Actions**

Project	Project Location	Project Description	Project Completion Date
ENEL Geothermal Power Plant	Salt Wells, NV (adjacent to the proposed Pony Express Switching Station and less than 2 miles from the Vulcan Project Area)	The 18-MW (net) power plant is located within an approximate 23-acre footprint. The plant operates with a substation, associated wells (5 production and 4 injection) and pipelines and a 6 mile transmission line.	Constructed, in operation.
Carson Lake and Pasture Land Transfer	Churchill County, NV	In 1990, Congress passed Public Law 101-618 in which Section 206(e) authorizes the Secretary of the Interior to transfer title of the 22,700 acres comprising the Carson Lake and Pasture area to the State of Nevada to be managed by NDOW as a Wildlife Management Area. An EA is in progress and the transfer is pending completion. Public Law-111-8 extends the CLP transfer completion date to June 30, 2012. The SPPC transmission line would cross the northeast boundary under all alternatives. Other portions of the routes are adjacent to but not within the CLP transfer boundary. Seven wells under Ormat's proposal are located within this transfer area.	Not specified at this time.
Newlands Project RMP	Washoe, Storey, Lyon and Churchill Counties, NV	An RMP to manage approximately 442,000 acres of Reclamation-administered land associated with the Newlands Project in Nevada.	ROD expected in Summer 2011.
Fallon Energy Park	Fallon, NV, on Reclamation Lands	A proposed Energy Park on Reclamation lands near Fallon Nevada	Not specified at this time.
Grimes Point Petroglyph Trail	Seven miles east of Fallon, within the no surface occupancy portion of the Ormat Project Area	The Trail features rocks with carvings as much as eight thousand years old, created by native peoples who were drawn to the shores of ancient Lake Lahontan. The site is a self-guided interpretive trail open to the public on BLM land.	Visited year round.

**Table 5-1
Past, Present and Reasonably Foreseeable Future Actions**

Project	Project Location	Project Description	Project Completion Date
OHV Races	Salt Wells, NV	It is likely that roads used for the Salt Wells Energy Projects could be listed as designated routes of travel when the travel management plan for Churchill County is completed. Currently, these routes can be considered existing routes of travel and provide opportunities for access to public lands for motorized recreation. As shown on Figure 3-23, roads within the proposed Salt Wells Energy Projects Area were authorized by the BLM as designated OHV race routes prior to 1993 for annual race events. Two of the major events are the Vegas to Reno and the VORRA Fallon 250 Desert Night Race.	Not specified at this time.
Pony Express National Historic Trail Re-Ride Event	Along the Pony Express National Historic Trail (traverses Salt Wells), NV	The Pony Express National Historic Trail runs from Highway 95 to the east near Buckland Station, crosses over Simpson Pass, and continues on to the east past Sand Mountain. The Pony Express National Historic Trail crosses near the Vulcan and SPPC Project Areas as shown on Figure 3-23. There are existing historical monuments on the west side of the Cocoons and at Simpson Pass, with an additional monument scheduled to be installed on the east side of the Cocoons near the ENEL Geothermal Power Plant. The National Pony Express Association conducts annual Re-Rides of the Pony Express National Historic Trail from St. Joseph, Missouri, to Sacramento, California. This re-ride is a 10-day, 24-hour a day, non-stop event by over 500 riders and horses. The 1,966 mile route travels over the Pony Express National Historic Trail from Missouri through Kansas, Nebraska, Colorado, Wyoming, Utah, and Nevada, to California. It is the longest event held annually on a historical trail in the nation.	Annually.

**Table 5-1
Past, Present and Reasonably Foreseeable Future Actions**

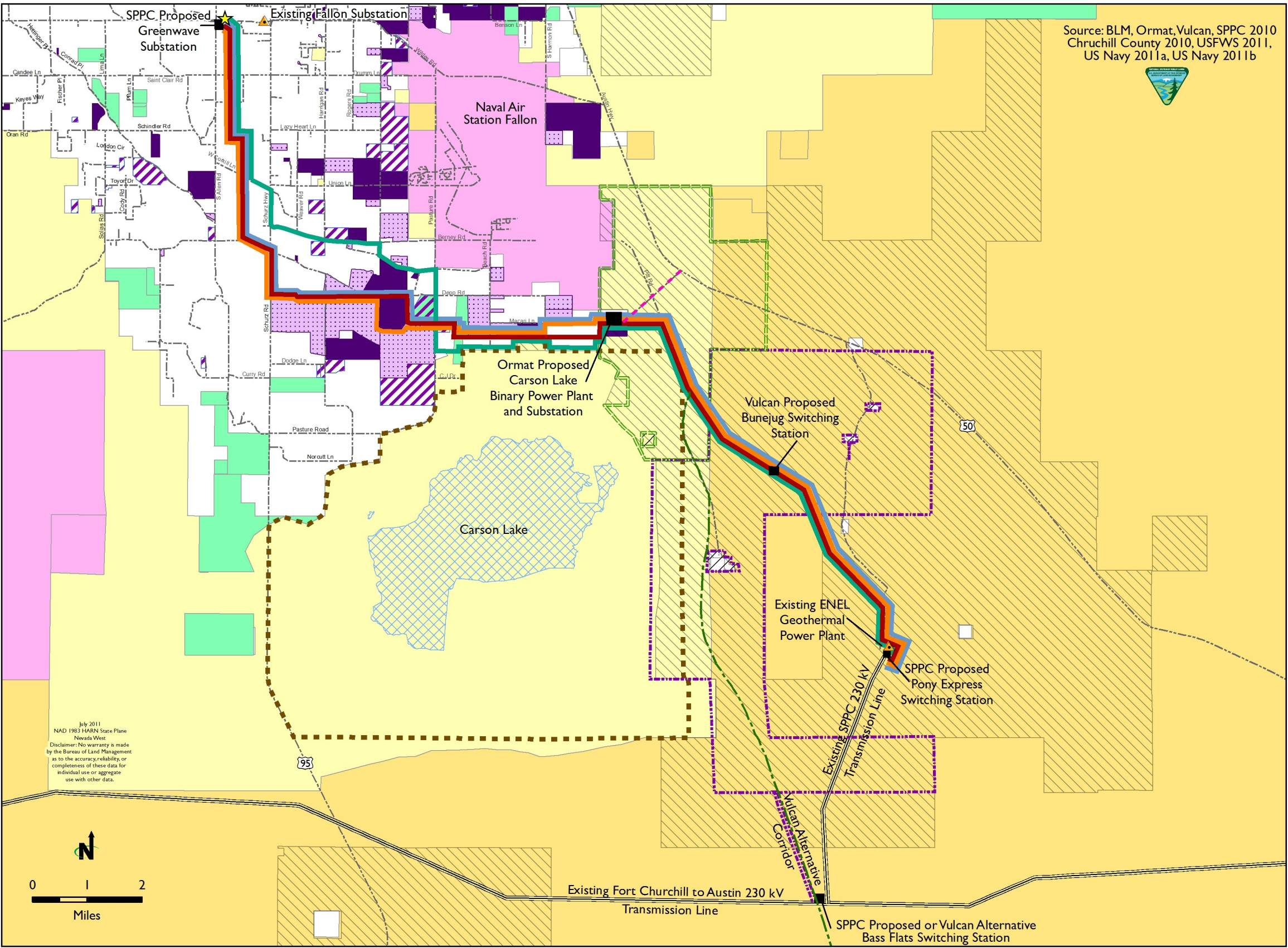
Project	Project Location	Project Description	Project Completion Date
Ormat Geothermal Exploration in Carson Lake/Salt Wells (Previously Permitted)	Salt Wells/Fallon, NV	Nine of the 12 well pads previously analyzed for the exploration phase would be used to the greatest extent feasible. (Three of the previously analyzed wells are on Navy property and are not part of any alternative analyzed in this EIS.) Therefore, the entire cumulative build out under Ormat's proposal would comprise a total of 22 well pads with multiple wells possible at each well pad. See Table 5-2 and Figure 5-2 for a complete list of permitted wells.	In progress—Two wells have been constructed.
Vulcan Geothermal Exploration in Salt Wells (Previously Permitted)	Churchill County, NV	Vulcan holds eight geothermal resource leases at Salt Wells, Nevada, issued by the BLM's CCDO, effective July 1, 2005. Vulcan has conducted initial exploration activities on these leases. On February 6, 2007, the BLM issued a Finding of No Significant Impact for ten exploration wells on these leases. On April 24, 2009, the BLM approved a Finding of No Significant Impact to construct ten additional well pads and access roads and to drill and test ten exploration wells at new locations established as the result of the initial exploratory activity. One other exploration well is proposed on private land and will include a Reclamation canal crossing. See Table 5-3 and Figure 5-3 for a complete list of permitted wells. Vulcan has drilled two observation wells and nine exploration wells.	In progress—Eleven wells have been constructed.
NAS Fallon Geothermal Program	Fallon, NV	NAS Fallon has retained permits to explore for geothermal development on their lands (part of which falls under the Ormat Geothermal Exploration); however, the geothermal program at the moment is on hold with no estimated start date in the near future.	In progress.

Table 5-2
Ormat Carson Lake/Salt Wells Previously Permitted Well Pads

Well Pad Number	Kettlemen Number	Lease Number	Township/Range	Section	Permanent Well Pad Area Acres
A	13-30	NVN 079105	18N30E	30	2.06
B	42-30	NVN 079105	18N30E	30	2.06
C	55-30	NVN 079105	18N30E	30	2.06
D	88-30	NVN 079105	18N30E	31	2.06
E	51-31	NVN 079104	18N30E	31	2.06
F	44-31	NVN 079104	18N30E	31	2.06
G	72-36	NVN 079104	18N29E	36	2.06
H	85-30	NVN 079105	18N30E	30	2.06
I	84-31	NVN 079104	18N30E	31	2.06
J	18-19	NVN 079105	18N30E	19	2.06
K	32-31	NVN 079104	18N30E	31	2.06
Q	11-32	NVN 079105	18N30E	32	3.10

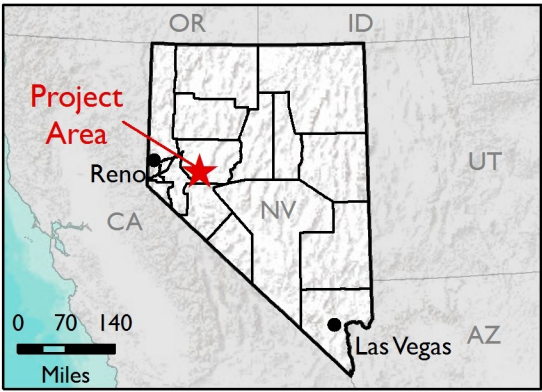
Table 5-3
Vulcan Power Permitted Salt Wells Well Pad Sites

Well Pad Number	Kettlemen Number	Lease Number	Township/Range	Section	Permanent Well Pad Area Acres
1	35-11	N-79666	17N30E	11	3.5
2	47-11	N-79666	17N30E	11	3.5
3	56-14	N-79665	17N30E	14	3.5
4	62-15	N-79310	17N30E	15	3.5
5	86-15	N-79310	17N30E	15	3.5
6	71-15	N-79310	17N30E	15	3.5
7	58-9	N-79666	17N30E	9	3.5
8	76-9	N-79666	17N30E	9	3.5
9	84-16	N-79665	17N30E	16	3.5
10	17-16	N-79665	17N30E	16	3.5
11	51-20	N-79663	17N30E	20	3.5
12	24-21	N-79663	17N30E	21	3.5
13	55-17	N-79665	17N30E	17	3.5
14	54-20	N-79663	17N30E	20	3.5
15	51-29	N-79663	17N30E	29	3.5
16	14-1	N-79668	17N30E	1	3.5
17	11-12	N-79666	17N30E	12	3.5
18	34-33	N-79664	17N30E	33	3.5
19	67-29	N-79663	17N30E	29	3.5
20	65-32	N-79664	17N30E	32	3.5

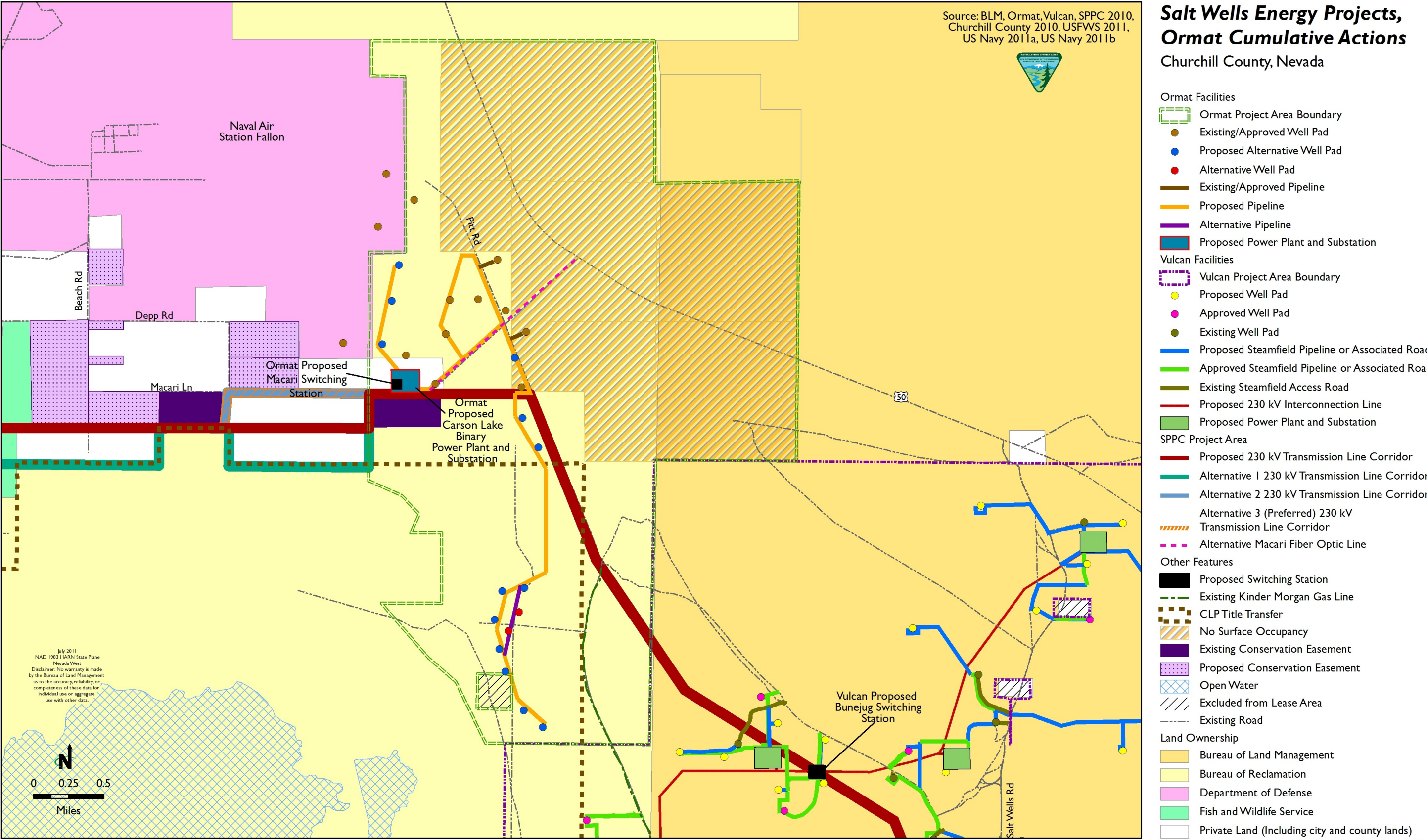


Salt Wells Energy Projects, Cumulative Actions Churchill County, Nevada

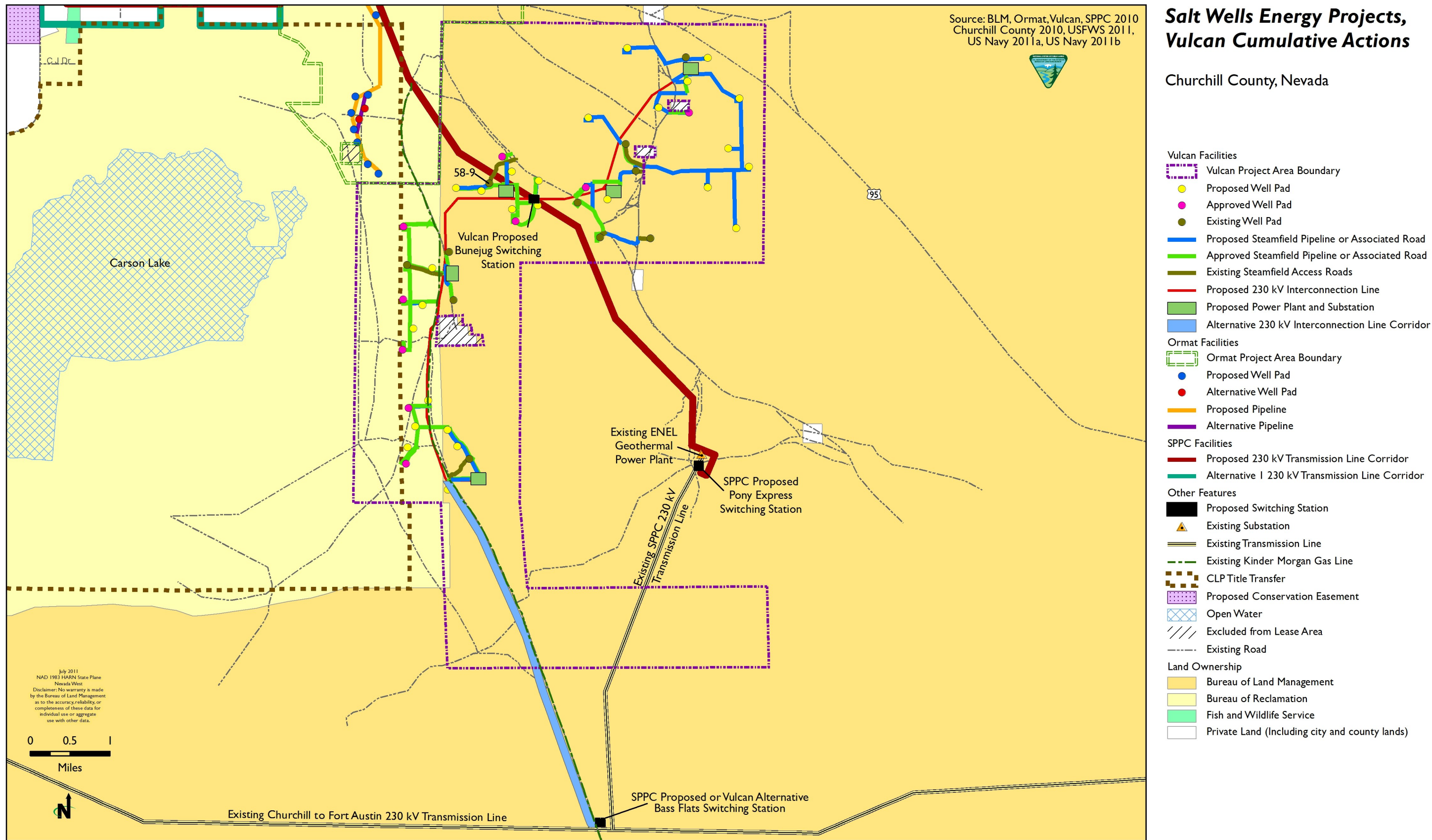
- SPPC Project Area
- Proposed 230 kV Transmission Line Corridor
 - Alternative 1 230 kV Transmission Line Corridor
 - Alternative 2 230 kV Transmission Line Corridor
 - Alternative 3 (Preferred) 230 kV Transmission Line Corridor
 - Alternative Macari Fiber Optic Line
 - Proposed 60 kV Linefold
- Vulcan Facilities
- Vulcan Project Area Boundary
- Ormat Project Area
- Ormat Project Area Boundary
- Other Features
- Proposed Power Plant or Substation
 - Existing Power Plant or Substation
 - Existing Transmission Line
 - Existing Kinder Morgan Gas Line
 - CLP Title Transfer
 - Authorized Geothermal Lease
 - Existing Conservation Easement
 - Approved, Pending Conservation Easement
 - Proposed Conservation Easement
 - Open Water
 - Excluded from Lease Area
 - Existing Roads
- Land Ownership
- Bureau of Land Management
 - Bureau of Reclamation
 - Department of Defense
 - Fish and Wildlife Service
 - Private Land (Including city and county lands)



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be taken consistent with implementing an Alternative, and they occur at the same time and place as those actions. Indirect impacts are caused by anticipated future actions to be taken consistent with the Alternative but occur later in time or farther in distance from those actions and are still reasonably foreseeable. These impacts are detailed in the environmental consequences sections of **Chapter 4**, Environmental Consequences, for each resource.

7. The potential impacting factors of each past, present, or reasonably foreseeable future action or activity are determined. Impacting factors are the mechanisms by which an action affects a given resource. Anticipated future actions to be taken consistent with all project Alternatives could also generate factors that could impact resources; these individual contributions form the basis of the cumulative impacts analysis.
8. The cumulative impact assessment focuses on: (1) the combined effects of implementing the three Proposed Actions (SPPC, Ormat, and Vulcan); and (2) the past, current, and reasonably foreseeable future actions, regardless of who undertakes them. In other words, the assessment considers other uses on all lands in the Projects Area regardless of land ownership.
9. Cumulative impacts on resources are evaluated by considering the impacting factors for each resource and the incremental contribution of anticipated future actions to be taken consistent with implementing the project Alternatives to the cumulative impact. The analysis for each resource is presented in **Sections 5.2 through 5.27**.

In cases where the contributions of individual actions to an impacting factor were uncertain or not well known, a qualitative evaluation of cumulative impacts was necessary. A qualitative evaluation covers the locations of actions, the times they would occur, the degrees to which the impacted resource is at risk, and the potential for permanent and/or synergistic effects.

5.2 LAND USE AUTHORIZATIONS, AIRSPACE, AND ACCESS

Region of Influence

The ROI for cumulative impacts land use, airspace, and access is the same as identified under the impacts for the Proposed Actions, which is the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan actions)

Cumulative impacts on land use, airspace, and access from the whole of the actions would be similar to those identified under the Proposed Actions in **Section 4.2**, Land Use Authorizations, Airspace, and Access. The SPPC ROW easements would have a permanent impact on approximately 177 to 212 acres

of private land. In addition, the projects have the potential to impact airspace and APZ areas designated by the Navy and historic portions of the Lincoln Highway or Highway 50. Mitigation would minimize these potential impacts; however, the combination of the projects would likely result in impacts on land use, airspace, and access.

Cumulative Impacts

It is assumed that under the cumulative impacts scenario, grazing would continue to operate, and impacts would be the same as under the Proposed Actions. Based on the cumulative project list identified in Table 5-1, six projects would affect land use, airspace, and access in addition to the Proposed Actions: the ENEL Geothermal Power Plant; the Carson Lake and Pasture title transfer; Newlands Project RMP; Fallon Energy Park; OHV races; and the NAS Fallon Geothermal Program. In addition, 33 land use authorizations (**Appendix F**) have been approved on BLM managed land in the ROIs and include Highway ROW, materials sites, transmission lines, fiber optic lines, geothermal leases, mineral material sales, and geothermal exploration. The cumulative projects could result in conflicts with existing or adjacent land uses, increase or modify access within the ROI, or conflict with airspace safety zones as designated by the Navy. However, the projects have or would require approval from the land management agency with jurisdiction of the project lands, and would be developed to be consistent with existing federal, state, and local land use plans and policies. Therefore, potential cumulative impacts on land uses, airspace, or access would be minimized.

5.3 AIR QUALITY

Region of Influence

The ROI for assessing regional air quality impacts is the western Salt Wells Basin and Lahontan Valley east of Highway 95.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Together, the Proposed Actions and Alternatives would impact air quality through construction of the proposed transmission line and associated facilities, well drilling, and operation of the geothermal power plants. The projects would have temporary and permanent effects on air quality as described in **Section 4.3, Air Quality**. Construction impacts would be localized in the case of fugitive dust. Fugitive dust is a recognized nuisance condition that would be effectively controlled through the implementation of standard BMPs and best practical methods. The combined emissions associated with construction equipment exhaust would have a regional impact; however, given the temporary nature of construction and the attainment status of air quality in the region, construction would not be expected to result in a violation of state or federal air quality standards.

Well drilling of the Ormat and Vulcan geothermal wells would result in cumulative air quality effects. However, well drilling would be temporary, ending once the well fields have been fully developed. The greatest source of emissions would occur with the drilling of production wells, which require large diesel-engine drill rigs. While a large number of wells are proposed, the limited number of drill rigs available to drill these wells would result in a limited number of such drill rigs operating at one time. Therefore, emissions associated with well drilling would not result in a violation of air quality standards.

Operation of the Ormat and Vulcan geothermal power plants would have limited effects on air quality in the case of binary power plants, as these power plants are closed systems that release few regulated pollutants. Effects associated with vapor plumes and drift would be effectively controlled by proposed mitigation measures.

Well drilling and the Vulcan flash power plant have the potential to release hydrogen sulfide, a state-regulated pollutant with the potential to affect human health in high concentrations and result in nuisance conditions at concentrations below the state standard. The amount of pollutant that would be released depends upon the amount present in the geothermal resource. Levels of this pollutant would be mitigated with abatement systems, if necessary, to ensure that levels remain low enough to protect human health and to abate odor nuisance conditions.

Cumulative Impacts

Combined with other past, present, and reasonably foreseeable future actions, the Proposed Actions would have incremental impacts on air quality in the region both temporarily and permanently. Direct impacts would result from any surface-disturbing actions that occur as part of future projects in the region. These impacts would be mitigated through established methods to control fugitive dust. Indirect impacts associated with management actions would occur; the extent of these impacts would depend on how many additional surface-disturbing activities would be allowed above current conditions.

Past, present, and reasonably foreseeable geothermal projects in the region have the potential to introduce regulated criteria pollutants and small quantities of air toxics associated with well drilling equipment, employee traffic, and maintenance equipment, as well as hydrogen sulfide found within geothermal fluid. With implementation of the measures described in **Section 4.3, Air Quality**, cumulative impacts caused by the Proposed Actions would be minimized, and no additional mitigation measures are recommended.

The proposed geothermal projects in combination with other geothermal projects in the region have the potential to directly and indirectly increase windblown fugitive dust conditions to the extent that the projects permanently reduce vegetation or cause a decrease in playas or the water table that dries out

soils. This condition would be exacerbated by climate change in an already arid region.

The proposed geothermal projects in combination with other geothermal projects in the region would also have an impact on global greenhouse gas emissions by introducing a renewable source of electrical power in the region, off-setting the need for energy production such as coal, oil, and natural gas that result in higher levels of greenhouse gas emissions. Direct CO₂ emissions for operation of various types of power generation are as follows (DOI and US Department of Agriculture 2008):

- Solar: 0 lbs CO₂/kWh
- Geothermal: 0.20 lbs CO₂/kWh
- Coal: 2.095 lbs CO₂/kWh
- Petroleum: 1.969 lbs CO₂/kWh
- Natural Gas: 1.321 lbs CO₂/kWh

5.4 MINERALS/GEOLOGY

Region of Influence

The ROI is the SPPC Survey Area and the Ormat and Vulcan Project Areas.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Past and ongoing development throughout the Salt Wells Energy Projects Area has resulted in minor alterations to the natural landscape. However, large scale future projects could contribute to the cumulative effects of geology and minerals creating a triggering or acceleration of erosion or slope failures, or an introduction of more people exposed to the effects of ground-shaking, earthquake-induced ground failure, and fault rupture (Patel 2009). Triggering or acceleration of erosion or slope failures would be limited to the areas within and adjacent to the boundaries of the individual projects. In order to be cumulatively considerable, such conditions would have to occur at the same time and in the same location as the Proposed Actions. It is unlikely that the Proposed Project impacts would have the potential to combine with similar effects from other projects and, as such, would not be cumulatively considerable.

Seismic impacts (ground-shaking, earthquake-induced ground failure, and fault rupture) from the numerous local and regional faults comprise an impact of the geologic environment on individual projects and would not introduce cumulatively considerable impacts. However, moderate to strong ground-shaking may occur at the Project sites during the life of the Projects and could result in collapse of Proposed Project structures. Collapse of Project structures could result in power outages, damage to nearby roads or structures, and injury or death to nearby people. Past and future projects located in close proximity

to project structures would be exposed to the same conditions and therefore the same impacts. Collapse of project structures and adjacent structures would combine to result in an impact where such structures are in close proximity to other structures or people.

Cumulative Impacts

This section includes an evaluation of cumulative impacts concerning geology and minerals.

Geotechnical impacts tend to be site specific rather than cumulative in nature, and each development site would be subject to, at minimum, site development and construction standards relative to seismic and other geologic conditions that are prevalent within the region.

The Proposed Actions and Alternatives, in combination with reasonably foreseeable development in the Salt Wells Energy Projects Area, would not contribute to cumulative geologic and mineral impacts, as the impacts would be site-specific. Impacts associated with geology and minerals are based on existing site-specific conditions that are situated within the subsurface materials that underlay project sites. Further, implementation of mitigation measures described in **Section 4.4** would ensure that the Salt Wells Energy Projects would not contribute to cumulative geologic and minerals impacts in the region.

If the Project activities are designed to comply with current design specifications, which minimize the potential for structure collapse or other mechanical faults, it is expected that seismic events would cause minimal potential damage. Therefore it is unlikely that seismic impacts on the proposed project would have the potential to combine with similar effects from other projects and would therefore not be cumulatively considerable. Cumulative geologic impacts would not occur.

Overall, contributions of the Proposed Actions and/or Alternatives to cumulative impacts concerning geology and minerals are found to be less than significant.

5.5 SOILS

Region of Influence

The ROI for cumulative impacts on soil resources includes areas where soil would be directly disturbed and adjacent areas that may be influenced by wind or water-borne sediment, which includes the SPPC, Ormat, and Vulcan Survey Areas.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The combined impacts on soils from the Proposed Actions can be separated into impacts in eastern areas that do not have agricultural use, and western areas that do have agricultural use. In the Salt Wells Energy Projects Area east

of and including the Ormat Survey Area, playas, dune land, bare rock, and areas of thin soil predominate. Construction activities in that area would disturb soil with high susceptibility to wind erosion, and would also disturb cryptobiotic soils. Development in areas with high susceptibility to wind erosion would require particular attention to mitigation measures that reduce soil disturbance and shorten the time that disturbed areas remain unvegetated. Mitigation measures would include leaving soil intact in some areas, and cutting vegetation at the ground surface. A reclamation plan would be developed for each project to guide rapid re-establishment of vegetation. Even with mitigation measures, minor amounts of wind erosion and nearby deposition of wind-deposited soil would occur where sufficient wind energy is applied. The areas east of Carson Lake and Pasture do not have a high percentage of vegetative cover, and access roads to project features could exacerbate destruction of the sparse vegetative cover by recreational use of OHVs, thereby increasing wind erosion. Reclamation plans would address restricting access of OHVs to construction areas and to areas in the process of reclamation.

In the Salt Wells Energy Projects Area west of the Ormat Survey Area, agricultural land use is predominant. Permanent impacts on agricultural soil resources from the whole of the actions would consist of direct conversion of soil to constructed non-soil features in the footprint of transmission towers. Additional soil would be affected on a temporary basis during construction by actions such as grading to form flat working surfaces at transmission structure and stringing sites.

Cumulative Impacts

Impacts on soils in the vicinity of the Salt Wells Energy Projects Area occur from activities that disturb the soil surface, remove native vegetation, or restrict the use of water for irrigation. Soil disturbance and the removal of native vegetation occur as a result of road construction, grazing, and other development activities such as the construction of geothermal facilities. In the case of irrigated lands, restrictions on water use leave previous farmland unvegetated and prone to soil loss by wind. If sufficient water is applied, however, agriculture has a low impact on soil quality in the Projects Area, and common management practices are effective at protecting soil from erosion. If water is no longer used for irrigation, sodium and salt effects on surface soils increase, and the capacity to support vegetation is severely reduced.

The Salt Wells Energy Projects would not divert significant amounts of potential irrigation water away from agricultural application, and would not negatively affect existing irrigation water quality. Because of this, the Salt Wells Energy Projects would not exacerbate the existing soil impacts associated with restricted irrigation.

In the areas east of Carson Lake and Pasture, grazing and OHV use currently cause destruction of vegetation and expose soil directly to wind erosion.

Impacts from the whole actions when combined with OHV use and grazing would result in impacts to soil resources. However, the Proposed Action and Alternatives would implement Environmental Protection Measures and reclamation and each project would be required to submit plans to NDEP and Churchill County outlining soil protection measures; therefore, potential cumulative impacts on soil resources would be minimized.

5.6 FARM LANDS (PRIME OR UNIQUE)

Region of Influence

The ROI for cumulative impacts on soil resources includes areas where soil would be directly disturbed and adjacent areas that may be influenced by wind or water-borne sediment, which includes the SPPC, Ormat, and Vulcan Survey Areas.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

No Unique Farmlands have been designated in the Salt Wells Energy Projects Area. The combined impacts on Prime Farmlands from the whole of the actions occur almost exclusively in the SPPC Project Area. No Prime Farmland is present in the Vulcan Project Area, and insufficient irrigation water is available to farm the lands categorized as Prime Farmland If Irrigated in the Ormat Project Area. As a result, the impacts to Prime Farmlands from the Whole of the Actions would be the same as those discussed for the SPPC Proposed Action or Alternatives (see **Section 4.6.2**).

Cumulative Impacts

The largest threat to potential Prime Farmlands near the City of Fallon is the removal of water rights. The amount of irrigated farmland near Fallon has decreased to approximately 45,000 acres from a previous high of 60,000 acres. This is due to many factors, including changes in upstream water rights and the purchases of water rights in the area. In addition to loss of irrigated land in the area, they also reduce the participation in and funding for the maintenance of irrigation canals. NAS Fallon has instituted a program to purchase and conserve adjacent lands in agricultural uses, and Churchill County has an easement purchasing program to promote farmland conservation. Residential development pressure has occurred but has been partially offset by the previously described conservation programs.

Due to the deficiency in precipitation (approximately 4 inches per year) compared to evapotranspiration (up to 50 inches per year), irrigation is necessary for productive farming in the vicinity of Fallon. However, the Proposed Action and Alternatives would not divert significant amounts of potential irrigation water away from agricultural application, and would not significantly affect existing irrigation water quality. The Salt Wells Energy Projects would allow water to be applied to the applicable Prime Farmlands if irrigated. Therefore, the whole of the actions would not decrease the potential

for Prime farmlands in the ROI when combined with other past, present, and reasonably foreseeable actions.

5.7 WATER QUALITY AND QUANTITY

Region of Influence

The ROI for the assessment of cumulative impacts on water resources is the same as for the direct and indirect impact assessment and consists of an area bounded by the following features:

- Western edge of the Carson Lake wetlands on the west (boundary between R28E and R29E);
- Eastern edge of Salt Wells Basin on the east;
- Fallon, Nevada on the north; and
- Southern edge of the Vulcan lease boundary.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Impacts from the whole of the Proposed Actions are summarized in **Table 5-4, Potential Direct and Indirect Impacts on Water Quality and Quantity**, below. These potential impacts are listed for the SPPC, Ormat, and Vulcan Proposed Actions, including Alternatives.

Cumulative Impacts

Cumulative impacts from the whole of the Proposed Actions (SPPC, Ormat, and Vulcan) would occur to water quality and quantity. The cumulative impacts on water resources are described qualitatively because no specific groundwater modeling has been completed to quantify the potential impacts.

The ENEL Geothermal Power Plant is located in the Salt Wells Energy Projects Survey Area, less than 2 miles east of the Vulcan Project Area; this facility has five production wells and four injection wells, along with pipelines and a 6-mile transmission line. If geothermal groundwater that would support the Vulcan and Ormat projects is pumped from the same aquifer used by the ENEL Geothermal Power Plant, then the following cumulative effects could occur: (a) change in quality and quantity of flows from thermal springs and seeps due to pumping; (b) reduction in groundwater in storage due to pumping; (c) change in deep groundwater flow paths and pressures; and (d) change in shallow groundwater quality from on-site septic systems. If relatively shallow groundwater is pumped from the ENEL Geothermal Power Plant for cooling water, then cumulative drawdown of groundwater could occur in the cool-water aquifers. These impacts would occur during the period of groundwater pumping and for some time thereafter, until the affected groundwater system recovers to near equilibrium conditions.

Table 5-4
Potential Direct and Indirect Impacts on Water Quality and Quantity

SPPC Action & Alternative	Ormat Action & Alternative	Vulcan Action & Alternative
Potential Direct Impacts - Cumulative		
Accidental release of chemical pollutants during construction, operation, and maintenance of facilities.	Same as SPPC	Same as SPPC
Change in quality and quantity of surface water from erosion and sedimentation caused by ground disturbance and removal of vegetation.	Same as SPPC	Same as SPPC
	Infiltration of drilling fluids and geothermal water from base of unlined reserve pit located at each drill pad (drilling mud would help seal pit bottom.)	Same as Ormat, except reserve pits would be lined with local clay material.
	Change in quality and quantity of flows from thermal springs and seeps due to pumping.	Same as Ormat
	Reduction in some groundwater storage due to pumping from >1500 ft. depth.	Greater reduction in ground-water storage due to higher water consumption for flash power plant(s).
	Change in deep groundwater (>1500 ft. depth) flow paths and pressures due to well pumping and reinjection.	Same as Ormat
	Affect water rights of other groundwater users in ROI.	Same as Ormat
	Makeup water needs (2500 to 3500 gpm April to October) would be obtained from existing rights on Newlands project canal; no impact by using existing water rights.	Makeup water needs (up to 11,000 gpm) for cooling would be from up to 20 ground-water wells; additional withdrawal impacts from cool water aquifer (approx. 750 ft. depth).
	Impacts to shallow groundwater quality from on-site septic system.	Same as Ormat

Table 5-4
Potential Direct and Indirect Impacts on Water Quality and Quantity

SPPC Action & Alternative	Ormat Action & Alternative	Vulcan Action & Alternative
Potential Indirect Impacts - Cumulative		
Minor changes in evapotranspiration from and recharge to shallow groundwater due to removal of vegetation.	Same as SPPC	Same as SPPC
	Overall change in water balance (e.g. recharge-discharge; evapotranspiration; groundwater flow systems).	Same as Ormat
	Diminished irrigation flows may reduce some recharge to shallow groundwater that occurs from the irrigation canals, and groundwater quality may be locally impacted by reduced influence of irrigation water.	

Additional similar cumulative impacts may occur on groundwater resources from the pumping of previously approved geothermal pumping and injection wells in the Ormat and Vulcan Project Areas. At the Ormat site, 12 pads were previously approved, with multiple wells at each pad. At the Vulcan site, 20 exploration wells have been approved. These previously permitted wells in both Project Areas, however, are for exploration purposes with pumping occurring only on a temporary basis.

A proposed energy park near Fallon, and a proposed geothermal program at NAS Fallon, could result in some cumulative impacts to geothermal groundwater resources if extraction wells are installed and put into production at one or both of these sites.

If any additional construction activities are completed at one or more of the sites mentioned previously, cumulative impacts on surface water could occur from increased erosion and sedimentation caused by ground disturbance and removal of vegetation. Mitigation using BMPs, however, would control these temporary impacts.

5.8 FLOODPLAINS, WETLANDS, AND RIPARIAN ZONES

Region of Influence

The ROI for cumulative impacts on floodplains, wetlands, and riparian zones includes the project lease areas, as well as Carson Lake and Pasture and the Salt Wells Basin.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

All projects would directly or indirectly affect some wetlands, including wet meadows, playas, and perennial wetlands. These are Waters of the State and require a permit to comply with Section 401 of the CWA. Vegetation removal and ground disturbing activities could increase the likelihood for erosion and sedimentation in nearby wetlands. All project proponents would create Stream, Wetland, Well, Spring, and Canal Protection Plans, Erosion Control Plans, and Spill Prevention Control Plans to reduce impacts.

Portions of the SPPC and Ormat Projects would be built within the 100-year floodplain. Neither of these projects would affect the locations of floods, and the project proponents would take precautions when working in flood areas to minimize impacts.

Cumulative Impacts

Combined with other past, present, and reasonably foreseeable future actions, the Proposed Actions would contribute incrementally to wetland, riparian, and floodplain disturbance and removal in the region both temporarily and permanently. Past, present, and future geothermal development and exploration would continue to disturb and destroy wetlands and riparian zones in the region due to project facilities, transmission line, and access roads. Increasing recreation pressure, including OHVs, would continue to disturb wetlands and riparian zones and spread weeds. If the Proposed Actions were constructed simultaneously with other projects, cumulative construction and operation impacts on wetlands, riparian zones, and floodplains could increase. If projects in the region were not successfully restored, wetland communities would be lost or permanently converted to communities dominated by invasive, nonnative species. Alternately, land use planning efforts could help prioritize areas for protection, particularly wetland, riparian, and floodplain areas. With implementation of applicant proposed measures and suggested mitigation measures in **Section 4.8, Floodplains, Wetlands, and Riparian Zones**, cumulative impacts caused by the Proposed Actions would be minimized, and no additional mitigation measures are recommended.

5.9 VEGETATION

Region of Influence

The ROI for vegetation resources encompasses the Salt Wells Energy Projects Area plus a one-mile buffer.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Together, the three Proposed Actions would have impacts on vegetation resources by removing native plant communities. The projects would have both temporary and permanent effects on vegetation. Temporary impacts on vegetation would be exacerbated by concurrent construction of the Proposed Actions. **Table 5-5**, Impacts on Vegetation Communities Associated with the Whole of the Actions, shows the total acres of impacted vegetation caused by the three Proposed Actions.

Table 5-5
Impacts on Vegetation Communities Associated with the Whole of the Actions

Vegetation Community¹	Temporary Impacts (acres)	Permanent Impacts (acres)
Greasewood flat	805	476
Mixed salt desert scrub	989	540
Playa	259	154
Emergent marsh and wet meadow	75	32
Agriculture and developed	389	165

¹ Note that riparian and active and stabilized dune habitat types were not mapped within the SWReGAP.

Source: SWReGAP 2010

Indirect impacts would be similar to those described in **Section 4.9**, Vegetation. Together, the projects could result in weed spread and soil disturbance over a large area, especially if constructed concurrently. In addition to the projects being located near existing development and agricultural lands, similar native vegetation communities in the region are abundant. Applicant proposed measures and suggested mitigation measures in **Section 4.9**, Vegetation, would reduce impacts and no additional mitigation measures are recommended. However, if revegetation were not successful, a residual impact would occur, and additional mitigation would be required to reduce this impact.

Cumulative Impacts

Combined with other past, present, and reasonably foreseeable future actions, the Proposed Actions would contribute to vegetation disturbance and removal in the region both temporarily and permanently. Past, present, and future geothermal development and exploration would continue to disturb and remove vegetation in the region due to project facilities, transmission lines, and access roads. Increasing recreation pressure, including OHVs, would continue to disturb native vegetation and spread weeds. If the Proposed Actions were

constructed simultaneously with other projects, cumulative construction and operation impacts on native vegetation could increase. If projects in the region were not successfully revegetated, native vegetation communities would be lost, or native vegetation communities would be permanently converted to communities dominated by invasive, nonnative species. Alternately, land use planning efforts could help prioritize areas for protection, particularly native plant communities. With implementation of applicant proposed measures and suggested mitigation measures in **Section 4.9, Vegetation**, cumulative impacts caused by the Proposed Actions would be minimized, and no additional mitigation measures are recommended.

5.10 INVASIVE, NONNATIVE SPECIES

Region of Influence

The ROI for invasive, nonnative species includes the Salt Wells Energy Projects Area and a one-mile buffer.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Together, the three Proposed Actions could cause the introduction or spread of invasive, nonnative species over a large area. The projects would have temporary and permanent effects on vegetation as described previously in **Section 5.9, Vegetation**.

Ground-disturbing activities, increased access, and increased urbanization caused by the Proposed Actions could contribute to increasing invasive, nonnative species. Invasive, nonnative species populations could expand, and new populations could take hold in areas that become disturbed by construction activities. These impacts may not be mitigated unless all parties cooperate in accepted weed control measures and efforts to revegetate with native species. With implementation of applicant-proposed measures and mitigation measures recommended in **Sections 4.9, Vegetation**, and **4.10, Invasive, Nonnative Species**, the Proposed Actions would have a minimal impact on introduction or spread of invasive, nonnative species.

Cumulative Impacts

Ground-disturbing activities, increased access, and increased urbanization caused by the Proposed Actions and other past, present, and reasonably foreseeable actions could contribute to increasing invasive, nonnative species in the region. The Proposed Actions would contribute incrementally to the spread of invasive, nonnative species. Invasive, nonnative species populations could expand, and new populations could take hold in areas that become disturbed by construction activities associated with geothermal exploration and development as well as increasing recreation and OHV use. These impacts may not be mitigated unless all parties cooperate in accepted weed control measures and efforts to revegetate affected areas with native species. With implementation of applicant-proposed mitigation measures, in addition to those recommended in

Sections 4.9, Vegetation, and 4.10, Invasive, Nonnative Species, cumulative impacts caused by the Proposed Actions would have a minimal impact on introduction or spread of invasive, nonnative species in the region.

5.11 WILDLIFE

Region of Influence

The ROI for wildlife resources includes Salt Wells Energy Projects Area plus a one-mile buffer. For game species, the NDOW hunt units are considered.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Impacts on wildlife habitats are presented in **Section 5.9, Vegetation.** Cumulative impacts on wildlife resources would be similar to those described in **Section 4.11, Wildlife,** but could be exacerbated if project schedules were to coincide. Construction of all three projects simultaneously could result in greater impacts from emissions, noise, construction equipment, vehicle traffic, and overall habitat degradation and loss. Impacts from habitat fragmentation as described in **Section 4.11, Wildlife,** would be more substantial for the three projects combined, as they would impact a larger area of habitat. In general, the larger area of developed land that would result from constructing the three projects would be less attractive to wildlife for use as foraging, wintering, migrating, or nesting habitat. Not all species would be harmed by conversion of land to more intensive uses, and many would adapt to the developed landscape and associated noise and human use, given the existing level of development and noise currently in the region. The projects are located near existing development and similar wildlife habitat types in the region are abundant. The applicant-proposed measures described in **Section 4.11, Wildlife,** would help to reduce impacts on wildlife caused by the Proposed Actions.

Cumulative Impacts

Cumulative impacts resulting from the Proposed Actions and other past, present, and reasonably foreseeable actions would be similar to those described previously for the whole of the actions. The Proposed Actions would contribute incrementally to impacts on wildlife. Existing, proposed, and approved geothermal exploration and development in the region would contribute similar impacts as the proposed project and could result in direct and indirect impacts on wildlife and habitat. Increased recreational uses in the region, including OHVs, could further disturb wildlife due to mortality, injury, and habitat degradation through noise, human presence, and weed spread. The combined effects of the conversion of wildlife habitats to developed uses associated with actions in the region could exacerbate impacts associated with the Proposed Actions through habitat fragmentation and loss. Implementation of applicant proposed measures in **Section 4.11, Wildlife,** would reduce cumulative impacts caused by the Proposed Actions. No additional mitigation measures are recommended.

5.12 MIGRATORY BIRDS

Region of Influence

The ROI for cumulative impacts on migratory birds considers effects within the Nevada flyway, including Carson Lake and Pasture and Stillwater National Wildlife Refuge.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts on migratory birds would be similar to those described in **Section 5.11**, Wildlife. The combined length of transmission lines from the three projects, particularly the SPPC and Vulcan Projects, would have a permanent effect on birds in the region. Birds utilizing Carson Lake and Pasture also use other nearby water bodies, such as the Stillwater National Wildlife Refuge, Harmon Reservoir, and S Line Reservoir. They travel between these wetlands with some regularity, and the transmission lines bisect this travel route, increasing the risk of collisions. Despite this permanent effect, birds would eventually adapt to the new power lines, and mortality levels are not anticipated to result in permanent loss of population viability for any species. The projects are located near existing development, and similar wildlife habitat types in the region are abundant. The applicant-proposed mitigation measures, in addition to those described in **Section 4.12**, Migratory Birds, would reduce impacts on birds caused by the Proposed Actions.

Cumulative Impacts

Cumulative impacts on migratory birds from the Proposed Actions combined with other past, present, and reasonably foreseeable future actions would be similar to those described previously for the whole of the actions. The Proposed Actions would contribute incrementally to impacts on migratory birds. Other geothermal exploration and development would further fragment habitats by erecting transmission lines. Increasing recreation, including OHV use, would degrade habitat through increased noise, human presence, and weed spread. Implementation of applicant-proposed mitigation measures, in addition to those described in **Section 4.12**, Migratory Birds, would reduce cumulative impacts caused by the Proposed Actions. No additional mitigation measures are recommended.

5.13 BLM-DESIGNATED SENSITIVE SPECIES (ANIMALS AND PLANTS)

Region of Influence

The ROI for BLM-designated sensitive animal and plant species includes the Salt Wells Energy Projects Area plus a one-mile buffer.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts on BLM-designated sensitive animal and plant species would be similar to those described previously in **Sections 5.11**, Wildlife, and **5.12**, Migratory Birds. In total, the projects could affect two BLM-designated sensitive

plant species, one BLM-designated sensitive invertebrate species, ten BLM-designated sensitive bird species, and eight BLM-designated sensitive bat species. Given their special status, all of these species are likely to be sensitive to habitat loss and fragmentation. Several of these species, including bats, golden eagle, and prairie falcon, are especially sensitive to human presence and disturbance. The projects are located near existing development, and similar wildlife habitat types in the region are abundant for use by BLM-designated sensitive species. Implementation of the applicant-proposed measures and mitigation measures described in **Section 4.13, BLM-Designated Sensitive Species (Animals and Plants)**, would help to reduce impacts on sensitive species caused by the Proposed Actions.

Cumulative Impacts

Cumulative impacts on BLM-designated sensitive animal and plant species from the Proposed Actions combined with other past, present, and reasonably foreseeable future actions would be similar to those described previously for the whole of the actions. The Proposed Actions would contribute incrementally to impacts on BLM-designated sensitive species. Other geothermal exploration and development would further fragment habitats by erecting transmission lines. Increasing recreation, including OHV use, would degrade habitat through increased noise, human presence, and weed spread. With the implementation of applicant proposed mitigation measures, in addition to those described in **Section 4.13, BLM-Designated Sensitive Species (Animals and Plants)**, cumulative impacts caused by the Proposed Actions would be reduced and no additional mitigation measures are recommended.

5.14 CULTURAL RESOURCES

Region of Influence

The ROI for cumulative impacts on cultural resources includes the Salt Wells Energy Projects Area plus a one-mile buffer. The architectural cultural resources ROI is a one-half-mile buffer about the proposed transmission line corridors.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Potential cumulative impacts on cultural resources, specifically historic properties, would include both direct and indirect effects. Direct impacts resulting from ground disturbance, vegetation removal, increased access, and artifact collection, as well as indirect impacts such as visual integrity compromise through construction of transmission lines, power plants, wells, and other highly visible facilities, are expected from the construction of the whole Action. Implementation of the mitigation and avoidance measures outlined in the Salt Wells Energy Projects Programmatic Agreement (2010), including development of site specific treatment plans and their implementation, would help reduce or mitigate adverse effects on historic properties found within the project APEs.

Cumulative Impacts

Cumulative impacts on cultural resources, specifically historic properties, from the Proposed Actions combined with other past, present, and reasonably foreseeable future actions would be similar to those described for the whole of the actions. The Proposed Actions would contribute incrementally to impacts to regional historic properties. Additional geothermal exploration and development would further add to the modern well pad, plant, pipeline, and transmission line developments that already occur in the region. Increasing recreation, including OHV use, might increase human presence and artifact collecting. With the implementation of applicant proposed measures such as avoidance of historic properties, and use of mitigation measures outlined in **Appendix D**, Programmatic Agreement for the Salt Wells Energy Projects, for cultural resources, cumulative impacts caused by the Proposed Actions would be reduced, and potential adverse effects mitigated.

5.15 NATIVE AMERICAN RELIGIOUS CONCERNS

Region of Influence

As identified in **Section 4.15**, Native American Religious Concerns, the ROI for cumulative impacts on Native American Religious Concerns is the Salt Wells Energy Projects Area and surrounding lands designated as traditionally important to the local Native American culture.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts on Native American Religious Concerns from the whole of the actions would be similar to those identified under the SPPC Proposed Action in **Chapter 4**, Environmental Consequences.

Cumulative Impacts

Within the ROI, cumulative impacts have occurred within lands that have provided, and continue to provide, sustenance as well as spiritual and religious renewal for the indigenous people. Mining-related activities, cattle grazing, and other actions in the cumulative ROI cumulatively have affected, or would affect, these resources and Fallon Paiute-Shoshone tribal tradition and lifeways.

5.16 PALEONTOLOGICAL RESOURCES

Region of Influence

The ROI for paleontological resources includes existing, approved, proposed, and reasonably foreseeable development within and around the City of Fallon, Nevada, and unincorporated areas of Churchill County in the vicinity of the Salt Wells Energy Projects.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

This section addresses potential cumulative impacts of the whole of actions, including SPPC, Ormat, and Vulcan, concerning paleontological resources. Paleontological resources include vertebrate, invertebrate, or plant fossils.

Paleontological investigations previously conducted within the Salt Wells Energy Projects Area identified paleontological localities, including significant paleontological localities within the boundaries of the Projects, resulting in a net loss of paleontological resources. There is also low the possibility for the inadvertent discovery of paleontological resources during ground disturbing project activities. Consequently, there is a low possibility that these projects could result in a net loss of paleontological resources.

If significant paleontological resources are present within the Projects Area, implementation of the mitigation measures outlined in **Section 4.16**, Paleontological Resources are expected to reduce the cumulative impacts on paleontological resources.

Cumulative Impacts

Adoption of the Proposed Actions or Alternatives (SPPC, Ormat, and Vulcan), along with any foreseeable development in the region, is unlikely to result in cumulative impacts due to the loss of as yet unrecorded paleontological localities. Such impacts would be reduced by mitigation implemented on a project-by-project basis. This contribution is considered, cumulatively, to be less than significant.

5.17 VISUAL RESOURCES

Region of Influence

The ROI for assessing regional visual resources impacts includes the viewsheds from KOPs along the SPPC corridor, viewsheds that include the Ormat Project Area and viewsheds that include the Vulcan Project Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The three Proposed Actions together would impact visual resources through construction of the proposed transmission line and facilities, well drilling, and operation of the geothermal power plants. There would be various temporary and permanent effects on viewsheds in the Salt Wells Energy Projects Area. Construction activities would be visible from area roadways, including Highway 95, Highway 50, and roads along transmission line corridors. Additional access roads, staging areas, and structural supports would be visible structures but would be removed when construction is complete. The combined effects of the construction of all three projects would have increased visual impacts and increased visibility. The temporary nature of the visual impacts from construction would not constitute a violation of BLM Class III VRM standards.

The Ormat and Vulcan geothermal power plants would be the most visible portions of the combined projects and would have cumulative visual effects. With proposed mitigation measures, the impacts from the power plants would be reduced, but would still exist. The geothermal power plants would be the most visible and would likely result in a noticeable change of visual character in the area.

The transmission line, substation, geothermal wells, and pipelines would be less immediately visible as they are smaller structures and they would blend in with existing infrastructure.

Cumulative Impacts

Past, present, and reasonably foreseeable geothermal projects in the region have the potential to introduce additional structures or equipment, transmission lines, roads, employee traffic, and maintenance facilities. Of the 20 previously approved Vulcan exploration wells, 11 have been constructed and are included in the baseline condition for visual resources. Additional wells constructed within the viewsheds of Highway 50 or Highway 95, which carry the most traffic in the area, combined with the Salt Wells Energy Projects, could have visual impacts in the area. The previously approved Ormat and Vulcan wells and well pads in the Salt Wells Energy Projects Area, when combined with the Salt Wells Energy Projects, could have visual impacts from the Highway 50 viewshed. The northeastern portion of the Ormat Project Area, which is the only portion of the Project Area highly visible from Highway 50, consists mostly of proposed and existing well pad locations. Only two previously approved well pads have not been construction and construction of these two locations would not likely cause additional impacts when combined with the Salt Wells Energy Projects.

Implementing proposed mitigation measures would reduce some impacts from the geothermal power plants. All other parts of the projects would have various cumulative effects.

5.18 LIVESTOCK GRAZING

Region of Influence

As identified in **Section 4.18**, Livestock Grazing, the ROI for cumulative impacts on livestock grazing includes BLM grazing allotments and Reclamation pastures that overlap with the proposed temporary and permanent disturbance areas (230-kV transmission line, pipelines, well pads, substations, interconnect transmission lines, switching stations, and power plants) on public land within the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts on livestock grazing from the whole of the actions would be similar to those identified in **Chapter 4**, Environmental Consequences. Temporary disturbance would be phased as construction of the three projects would not take place simultaneously. **Table 5-6**, Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Whole of the Actions, depicts approximate acreage of disturbance collectively from the three Proposed Actions. Under this scenario, less than 1 percent of the forage within the Bass Flat Allotment and the Carson Lake and Pasture would be permanently lost. Approximately 1.45 percent of the forage base would be lost within the Rock Springs Allotment, and over 3 percent of the

forage base would be lost in the Grimes Point Pasture (which is the same as identified under the Proposed Action). Collectively these permanent disturbances encompass a greater amount of acreage than under the individual projects; however the loss of permanent forage would not necessitate reduction in AUMs or removal of any cattle.

Table 5-6
Approximate Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands Under the Whole of the Actions (SPPC, Ormat, and Vulcan)

Allotment/ Pasture	Land Ownership	Temporary Disturbance (acres)**	Permanent Disturbance (acres)**
Rock Springs	BLM	1,117	615
Bass Flat	BLM	98	64
Carson Lake and Pasture	Reclamation	333	186
Grimes Point	Reclamation	105	61
Harmon Pasture	Reclamation	0	0

*The Proposed Actions were used for representative disturbance calculations for all three projects.

**Includes 230-kV transmission line, pipelines, well pads, substations, interconnect transmission lines, switching stations, and power plant disturbances on public land (if applicable).

The potential reduction in water quantity caused by consumptive water use associated with the Ormat and Vulcan projects could displace cattle from the Rock Springs allotment and cause cattle to concentrate in other areas, as described in **Chapter 4**. Collectively, this impact would be greater than impacts from either of the projects individually.

Cumulative Impacts

It is assumed that under the Carson Lake and Pasture title transfer, grazing would continue to operate, and impacts would be the same as under the Proposed Actions. Based on the rest of the cumulative project list identified under Table 5-1, only three projects would affect livestock grazing in addition to the Proposed Actions: the ENEL Geothermal Power Plant, Ormat's previously permitted exploration program, and Vulcan's previously permitted exploration program. **Table 5-7**, Approximate Cumulative Acreage of Disturbance of Grazing Allotments or Pastures on Public Lands, depicts the acreage of base forage that would be permanently lost under each of the Proposed Actions and the whole of the actions in combination with identified cumulative projects. The combined loss of forage acreages and potential for water quantity reduction are slightly greater than identified under the Proposed Actions or the whole of the actions. Under the worst cumulative case scenario (the whole of the actions plus any identified cumulative projects), Grimes Point Pasture would lose 4 percent of available grazing forage. Considering that only 16 cattle graze on the Grimes Point Pasture during the grazing season, enough forage would be available to sustain the herd.

Table 5-7
Approximate Cumulative Acreage of Disturbance of Grazing Allotments or
Pastures on Public Lands

Allotment/ Pasture	Permanent Disturbance-Proposed Action	Permanent Disturbance-Identified Cumulative Projects (acres)**	Total Permanent Disturbance
SPPC Proposed Action plus Identified Cumulative Projects*			
Rock Springs	97	89	186
Bass Flat	6	4	10
Grimes Point	0	14	14
Carson Lake and Pasture	34	0	34
Ormat Proposed Action plus Identified Cumulative Projects*			
Grimes Point	61	14	74
Carson Lake and Pasture	92	0	92
Vulcan Proposed Action plus Identified Cumulative Projects*			
Rock Springs	518	89	607
Bass Flat	59	4	67
Grimes Point	0	14	14
Carson Lake and Pasture	61	0	61
Whole of the Actions plus Identified Cumulative Projects*			
Rock Springs	615	89	704
Bass Flat	65	4	69
Carson Lake and Pasture	152	0	152
Grimes Point	61	14	74

* The Proposed Actions were used for representative disturbance calculations for all three projects. Identified Cumulative Projects=Vulcan Power previous Exploration Program, Ormat Previous Exploration Program and the ENEL Geothermal Power Plant.

**Includes 230-kV transmission line, pipelines, well pads, substations, interconnect transmission lines, switching stations, and power plant disturbances on public land (if applicable).

5.19 RECREATION

Region of Influence

The ROI for assessing cumulative recreation impacts is the Salt Wells Energy Projects Area. Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions).

The three Proposed Actions together would impact recreation through construction of the proposed transmission line and facilities, well drilling, and operation of the geothermal power plants. There would be various temporary and permanent effects on recreation in the ROI. Construction activities would create noise and visual changes that could impact visitor satisfaction with existing recreation areas or uses temporarily. The SPPC transmission line and power plants would have longer-term impacts related to noise and visual

changes. The projects would also result in increased roads in the ROI and the potential for increased OHV use of the area. These impacts would be reduced through the reclamation of temporary access, centerline, and spur roads. Access for recreation in the ROI would be mitigated to minimize impacts to wildlife viewing and hunting in the Carson Lake and Pasture area. Therefore, the projects would not result in permanent cumulative impacts.

Cumulative Impacts

It is assumed that under the Carson Lake and Pasture title transfer, recreational use would continue and impacts would be the same as under the Proposed Actions. Based on the rest of the cumulative project list identified under Table 5-1, only three projects would affect recreation in addition to the Proposed Actions; the ENEL Geothermal Power Plant, Ormat's previously permitted exploration program, and Vulcan's previously permitted exploration program. The VORRA race route was moved to address safety concerns associated with the ENEL Geothermal Power Plant and facilities. In addition other future geothermal projects in the region have the potential to introduce additional structures or equipment, transmission lines, roads, employee traffic, and maintenance facilities. Cumulative impacts caused by the Proposed Actions would range from moderate to minor. Of the 20 previously approved Ormat exploration wells, 11 have been constructed and are included in the baseline condition for recreation resources. Additional wells constructed within the ROI, combined with the Salt Wells Energy Projects, could result in recreation impacts in the area if OHV use increased or if recreational access was modified. The previously approved Ormat, Vulcan, and ENEL activities in the Salt Wells Energy Projects Area, when combined with the Salt Wells Energy Projects, could result in cumulative impacts on recreation.

5.20 NATIONAL SCENIC AND HISTORIC TRAILS

Region of Influence

The ROI for National Scenic and Historic Trails includes a ten-mile buffer around the SPPC Survey Area and Ormat and Vulcan Project Areas.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The SPPC and Ormat Projects would not contribute to impacts on National Scenic and Historic Trails. As such, the SPPC and Vulcan Projects would be the only source of impacts. Impacts from the whole of the actions would result from the SPPC and Vulcan Projects, as described in **Section 4.20**, National Scenic and Historic Trails.

Cumulative Impacts

The existing ENEL Geothermal Power Plant and associated facilities east of the Bunejug Mountains are a source of degradation to the viewshed, which currently may impact visitor satisfaction along this portion of the Pony Express National Historic Trail. Mitigation measures were applied for the ENEL Geothermal

Power Plant project to reduce visual impacts. The proposed Vulcan Project would compound this degradation, although the Vulcan power plant that would be visible is farther from the Pony Express National Historic Trail than the ENEL Geothermal Power Plant. Other projects, particularly geothermal and other energy generation projects, could permanently degrade the viewshed if they were visible from the Pony Express National Historic Trail. In addition, cumulative projects could have temporary impacts if construction activities were to occur on the Pony Express National Historic Trail. Mitigation measures would be required for all projects to reduce impacts and to preserve the historic qualities for which the Pony Express National Historic Trail was designated.

5.21 NOISE

Region of Influence

The ROI for cumulative impacts on noise includes a one-mile buffer around the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The three projects would not combine to cumulatively increase noise for any sensitive receptors within 1 mile of the ROI during either construction or operation; however, two of the projects, the SPPC Project and the Ormat Project, could result in cumulative impacts on the residence located approximately 0.35 mile to the west of the proposed Ormat power plant location. This cumulative impact would occur only under the following conditions:

- Under SPPC Alternative 2, which would locate the transmission line within 500 feet of the residence; and
- If construction activities of the transmission line under Alternative 2 were to occur at the same time as construction of the power plant, construction of Carson Lake Substation, construction of the well pad, access roads, or pipeline associated with well C-i, or at the same time as the drilling or flow testing of well C-i.

Cumulative Impacts

No cumulative impacts are anticipated from the whole of the actions when combined with the identified cumulative project list; however, the whole of the actions may result in cumulative noise impacts on sensitive receptors near the SPPC and Ormat Project Areas when combined with existing noise from NAS Fallon overflights. Such cumulative impacts would be temporary for the construction phase of the project and permanent for the operational phase of the project.

5.22 PUBLIC HEALTH AND SAFETY

Region of Influence

The ROI for cumulative impacts on public health and safety is the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Together, the three Proposed Actions could increase the amount and extent of public safety hazards in the ROI, especially if the projects were concurrent, having potential impacts on workers and the general public. All projects would implement BMPs and would comply with public health and safety regulations, as described in **Section 4.22**, Public Health and Safety.

Implementing the whole of the actions would cumulatively increase the number of EMF sources in the ROI, although impacts would be localized to the source. The level of EMF at the edge of the ROW for all projects would be low, as described in **Section 4.22**, Public Health and Safety.

Cumulative Impacts

While there are many sources of EMF currently in the ROI, impacts tend to be localized to the source. The number of sources would likely increase as development continues in the region, particularly geothermal and other energy development. Projects would be expected to implement mitigation measures if EMF levels were high at the edge of the ROW, thus minimizing cumulative impacts.

The combination of hazardous materials and other health and safety risks associated with the development and operation of geothermal and other energy facilities in conjunction with similar health and safety concerns for other reasonably foreseeable projects in the region is expected to be within acceptable levels. All projects would have to comply with state and federal requirements pertaining to worker safety and the use, storage, transport, and disposal of debris and hazardous materials and wastes, thereby minimizing cumulative impacts. The potential for hazardous waste spills (fuel, drilling muds, etc.) would be minimized through the application of BMPs included in lease terms and would not be at a large enough scale to cumulatively affect human health and safety within the ROI.

5.23 FIRE MANAGEMENT

Region of Influence

The ROI for fire management includes the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

All three projects and Alternatives could cumulatively increase the potential for fire within the ROI. Direct impacts would be greater if construction of the projects were concurrent, as this would expose a greater area to fire hazards at

the same time, thus increasing the risk of a large, catastrophic fire should multiple fires occur. However, all three project proponents would implement BMPs to reduce the likelihood for fire and improve fire management during construction and operation of the projects. No indirect cumulative effects on fire management are anticipated.

Cumulative Impacts

Cumulative impacts caused by other geothermal and energy development in the area could increase the potential for fire within the ROI. Direct impacts would be greater if construction of several projects were concurrent, as described previously. It is assumed that all project proponents would implement similar BMPs to prevent the likelihood of fire during construction and operation of the projects. In addition, cumulative impacts involving wildfires would be reduced given that local cities and Churchill County continue to provide increased firefighting services as development increases.

5.24 WASTES, HAZARDOUS OR SOLID

Region of Influence

The ROI for hazardous and solid wastes includes the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

The Proposed Actions would increase the amount of hazardous and solid wastes in the ROI, particularly if projects were concurrent. This could increase public health and safety concerns and stress the capacity of the waste disposal stream. BMPs implemented for the projects would reduce potential impacts to the environment. All solid and hazardous wastes generated during construction and operation of the projects would be transported to licensed facilities off-site for treatment and disposal. These wastes cannot be quantified at this time with any degree of certainty; however, in the context of existing and foreseeable solid and hazardous waste generation locally, the projects would constitute a minimal increase in waste generation and management, well within existing capacities and infrastructure. Therefore, construction and operation activities associated with the whole of the action would not cause or contribute substantially to cumulative impacts with respect to hazardous materials handling within the ROI.

Cumulative Impacts

Projects that could contribute to cumulative impacts in the area are mainly other geothermal or energy development projects. Existing, permitted, and proposed energy development projects would generate hazardous waste during construction, with less waste generated during operation and maintenance. These projects would likely be spread out geographically and temporally, thereby reducing demands on the hazardous waste disposal stream.

Other identified cumulative projects would be required to comply independently with hazardous materials regulations, depending on the nature and quantities of hazardous materials stored and used. As stated for the whole of the action, all solid and hazardous wastes generated during construction and operation of the projects would be transported to licensed facilities off-site for treatment and disposal and would not likely impact the waste disposal stream. Therefore, project construction and operation activities would not cause or contribute substantially to cumulative impacts with respect to hazardous materials handling within the ROI.

5.25 SOCIAL AND ECONOMIC VALUES

Region of Influence

The ROI for cumulative impacts on Social and Economic Values is Churchill County.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

Cumulative impacts of the Proposed Actions include the direct addition of up to 405 construction jobs. This addition would represent a 24.7 percent change from the 1,642 workers in the 2008 Churchill County construction workforce. Construction employment, while substantial, is not likely to result in permanent changes to the local population base or put a significant strain on local services. It is likely that construction employment needs would be staggered and that many employees would be available from the local area, thus a large influx in population is not anticipated. In addition, the high rate of housing vacancies in the County (19.5 percent in Churchill County in 2009) would make it likely that any influx of temporary employees could be absorbed without a strain on the local housing market. Finally, the high rate of unemployment in the region due to the recent economic downturn (9.1 percent in Churchill County in 2009) increases the availability of workers in the region. The temporary employment would bring an economic benefit to the local area by adding local job opportunities and bringing additional income into the County.

Permanent employment would represent an additional 69 employees. Assuming maximum direct employment, using an economic multiplier of 2.5 as defined in **Section 4.25**, Social and Economic Values, there is the potential for 173 jobs being added to the local economy as quantified for the Vulcan power plant project. This change represents a 1.4 percent increase from baseline County total employment. Additional employment needs for the SPPC transmission line or Ormat power plant and well pads have not been determined. Should these projects require permanent employees, they are likely to be less than the needs of Vulcan due to the smaller proposed project size. Therefore, total County employment is not likely to change by more than 2 to 3 percent. Even if full employment needs were recognized and all employees were recruited from outside the County, this increase is not likely to impact the local housing market or public services.

Cumulative impacts on property values include a total of up to 158 agricultural, industrial, and rural residential parcels potentially requiring compensation for property easements for the SPPC Proposed Action. Area properties in the vicinity of proposed transmission lines, new substations, and power plants may also experience changes in property values; however the amount cannot be quantified here due to the importance of other factors in determining property values. Impacts are expected to be minimal as the rural or industrial setting of the area would result in lesser impacts than in a more densely populated residential setting.

Additional cumulative impacts include contributions to the local government tax base from the construction of the Salt Wells Energy Projects and possible indirect tax contributions as a result of increased economic activity in the local area.

Cumulative impacts on recreation could also affect the local economy should the Proposed Actions impact the current dispersed recreational uses, including hunting, wildlife viewing, and OHV use. Revenues associated with recreation could decline if these activities were reduced or eliminated, or increase if they were made more accessible. The Pony Express National Historic Trail may be impacted by portions of both the SPPC and Vulcan Projects. Portions of these Project Areas would be unavailable for recreation during construction of the transmission lines, switching stations, and substations; the switching stations, substations, and power plant sites would be permanently unsuitable for recreation. Additional access roads required for the projects may increase access for recreational activities in the area until such roads are reclaimed. While some areas used for recreation would be impacted, recreation in the region is dispersed and there are plenty of other open and public lands available for such uses. No cumulative impact on money spent on recreation is expected.

It is not anticipated that cumulative impacts would affect the economic livelihood of ranchers and herders. Details are provided in **Section 5.18, Livestock Grazing**.

Cumulative Impacts

Past, present, and reasonably foreseeable geothermal projects in the region have the potential to introduce additional socioeconomic impacts to the ROI, including additional job creation and related economic and social impacts, as well as changes to property values.

The previously permitted Ormat and Vulcan Geothermal Explorations are in progress and may require some additional construction and operational employment. Cumulative impacts on construction employment numbers and related demands on area housing and public services would only occur should construction happen simultaneously with the Salt Wells Energy Projects. Work is in progress on both previously permitted projects. Commutative build out under Ormat's permitted project would comprise a total of twenty four (24)

well pads with multiple wells possible at each well pad, of which two well pads have been constructed. Permitted work on Vulcan Salt Wells Exploration Project includes 20 permitted wells, of which 11 have been constructed. Permanent impacts on the local population base and economy resulting from these permitted projects are unlikely, since there would be little permanent employment.

Additionally, a proposed energy park on Reclamation-administered lands near Fallon and the NAS Fallon Geothermal Program may add employment opportunities, but no specific plans for development in the near future are known at this time. The ENEL Geothermal Power Plant is complete and in operation. Any impacts of this plant and other operational power plants have been included in the current conditions discussion.

Impacts on private property value by present or foreseeable projects have been and would be assessed on a case-by-case basis by each proponent. It is possible that if the Proposed Actions or any of the project Alternatives are constructed, more development, such as other energy, infrastructural, industrial, commercial, or residential projects, would be built in the same area. This may or may not result in a permanent change to the rural nature of the area with potential impacts on current land uses such as recreation and ranching.

5.26 ENVIRONMENTAL JUSTICE

Region of Influence

The ROI for cumulative impacts on Environmental Justice is the Salt Wells Energy Projects Area.

Impacts from the Whole of the Actions (SPPC, Ormat, and Vulcan Actions)

There are no known minority or low income populations fitting the definition for environmental justice concerns within the Salt Wells Energy Projects Area. Therefore, there are no cumulative impacts on an environmental justice population as a result of the Proposed Actions.

Cumulative Impacts

There are no known minority or low income populations fitting the definition for environmental justice concerns within the Salt Wells Energy Projects Area. Therefore, there are no cumulative impacts on an environmental justice population as a result of the Proposed Actions.